Smart Water Sessions

Session 1 – Principles of Smart Wastewater
Speakers – **Oliver Grievson**

Oliver Grievson is the Chairman of Wastewater Education 501 (c)3, the Executive Director of Water Industry Process Automation & Control & the Technical Lead at Z-Tech Control Systems.

He has over 20 years experience in the Water Industry working in everything from operations management, technical management……

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Speakers – John Cook

CEO Advanced Data Mining Intl.

ADMi (www.advdmi.com) deploys data mining/advanced analytics to solve complex environmental problems using machine learning, process modeling and optimization, event detection, and decision support systems (DSS). ADMi works with water and wastewater utilities and researchers, and state and federal science regulatory agencies.

Prior to joining ADMi, John worked for Charleston Water System (South Carolina) for 22 years as Director of Engineering, COO, and CEO. He oversaw environmental improvements using ISO 14001, decision support systems, hydrology and water quality models, and data mining/analytics.

John is a P.E. and AWWA member; with B.S., M.E. Engineering Mechanics from U. South Carolina, and M.S. Environmental Engineering from Colorado State U.

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Speakers – **Leiv Rieger**

Leiv Rieger, PhD, P.Eng., CEO of inCTRL Solutions, specializes in **instrumentation, monitoring, modeling, and control** of water resource recovery facilities.

Leiv is the 2015 recipient of WEF’s Eddy Wastewater Principles/Processes Medal for his paper on Ammonia-based Aeration Control and is a Fellow of the International Water Association (IWA).

In his “free” time, he serves as member of the Core Editorial Board for *Water Science & Technology*.

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Speakers – *Ben Kele*

**Director at Arris Water – Member of Board WasteWaterEducation.org**

**Rockhampton, Australia**

Ben is Director and co-founder of Arris Water a company that specializes in decentralised water treatment and recycling systems.

Researcher in Zeolites and other volcanic filter media

Holder of two innovation patents for wastewater treatment technologies

Co-developer and lecturer in the ICEWaRM Post Graduate course the Engineered Water Cycle

Co-developer and co-lecturer in the IWES Decentralised Wastewater Treatment Systems course

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What is Smart Water

*Smart Water*

Water 4.0???

*Digital Transformation*???
What is Smart Water

What does it actually mean?

It can mean what it actually is which is a collection of buzz words or it can mean quite a lot.

We have to look at the application of solutions within the water industry and look at three elements

- Technology
- People
- Processes
The Operational response

- Weather Report Analysis in the control room
- Technical Team in the control room
- Operational Response
- Technical Team Prioritise Sites
- Trigger Alert

What does it mean to you?
The blockage timeline

- Dry spell — material build up in sewers
- Rain — blockages cause pollution events
- Rainfall event clears blockages
- Dry spell — material build up in sewers

The Problem

- 35% improvement needed across the AMP5
- We had already lost ground in the first two years
- £500k shortfall for every incident above our agreed targets
- Forecast to outturn 12 incidents above target – £6million shortfall risk
- Our improvement programme wasn’t achieving targets
- Unexpected deterioration in 2013 performance

What does it mean to you?
A case study – *The Blockage Timeline*

A case study from James Harrison demonstrating what Yorkshire Water did to reduce Pollution Incidents due to performance need that was threatening to affect financial situation of the company

James Harrisons main points were:

- Yorkshire Water’s performance was suffering and needed improvement
- They were taking a Cyclical Approach with £1.5million on cleaning and £8million on CCTV
- The data that they needed to inform their decision making was already being collected within the business and understanding the problem was what it took to discover what needed to be done
- The answer was the analysis of the “blockage timeline” where they discovered that after a prolonged dry spell blockage areas were more likely to cause pollution incidents depending upon the intensity of the rain
- Achieved a 21% reduction in pollution incidents by reorganising and working more effectively
- A quick response is no longer acceptable and predicting where problems are going to occur are key to future successes
Lots of potential – *Control Based Permitting*

Work done by Professor David Butler at Exeter University looking at operational control based permitting.
Lots of potential – *Control Based Permitting*

<table>
<thead>
<tr>
<th>Operational variables</th>
<th>Permit value</th>
<th>Permit range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass forward flow (dry weather flow, i.e. DWF)</td>
<td>6.7</td>
<td>[6.4, 7.1]</td>
</tr>
<tr>
<td>Flow to full treatment (DWF)</td>
<td>4.4</td>
<td>[4.4, 4.5]</td>
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<tr>
<td>Storm tank emptying threshold (m³/h)</td>
<td>820</td>
<td>[784, 860]</td>
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<tr>
<td>Storm tank emptying rate (m³/h)</td>
<td>530</td>
<td>[491, 573]</td>
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<tr>
<td>Return sludge pumping rate (m³/h)</td>
<td>880</td>
<td>[875, 893]</td>
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<tr>
<td>Waste sludge pumping rate (m³/h)</td>
<td>10.7</td>
<td>[10.6, 10.8]</td>
</tr>
<tr>
<td>Aeration rate (m³/h)</td>
<td>28,800</td>
<td>[28,573, 29,039]</td>
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</tbody>
</table>

Compared to baseline control scenario:

- 50% less energy cost;
- 90% lower pollutant discharge load;
- 80% higher operational stability;
It doesn’t have to be complex
Ok I get the technology.....but do we really need it?
Case study from Portugal where water leakage in Lisbon was a steady 23-25% for the previous 8 years.

A change in strategic direction...... through the adoption of smart principles......
Leakage reduction won’t be enough
• Trial within Anglian Water Shop Window area with Advizzo, a company that looks to help customers to reduce water usage.

• Couple this with Smart Water Meters and the reduction in usage through both methodologies can be significant.

And together with PCC reduction
Before we get too complex
The first thing to understand is:

We measure the physical layer
We communicate the data
We convert it into useable information
We make an informed decision

This is Simple but SMART
Infrastructure
Infrastructure
Instrumentation
Instrumentation & Control
Communications
<table>
<thead>
<tr>
<th>Generation</th>
<th>Bandwidth</th>
<th>Speed Range</th>
<th>Latency</th>
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<tbody>
<tr>
<td>3G</td>
<td>380MHz - 1900MHz, 800MHz - 900MHz, 1800MHz</td>
<td>900MHz, 2100MHz</td>
<td>100ms</td>
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<tr>
<td>4G</td>
<td>700MHz, 800MHz - 1800MHz, 2100MHz, 2300MHz, 2600MHz/2.6GHz, 2-8GHz, 3.4GHz, 3.8GHz</td>
<td>0.1Mbps - 1.5Mbps, 4Mbps - 8Mbps</td>
<td>50ms</td>
</tr>
<tr>
<td>5G</td>
<td>Sub-1GHz, 3.4GHz, 3.8GHz, 4.5GHz, 24-27.5GHz</td>
<td>15Mbps - 80Mbps, 60Mbps - 90Mbps, 150Mbps - 200Mbps</td>
<td>1-4ms, 30ms</td>
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<tr>
<td>(tbc)</td>
<td>950MHz (tbc)</td>
<td>1GHz (tbc)</td>
<td>(tbc)</td>
</tr>
</tbody>
</table>
Visualisation
**Eastney ICMLive Setup**

- **Real time data**
  - Radar
  - Telemetry (Rain gauges, water levels, pump operation)

- **ICMLive**
  - InfoWorks ICM model

- **Email alerts and visual warnings**

- **Decision making**
  - Dissemination
  - Forecasted pump operation
  - Automated model runs
These are the jigsaw pieces but how do we make a whole?
Its all about the data …

The industry has data…..lots and lots of data from lots and lots of instruments….going by the number of telemetry data points in the UK there are approximately

- 400 million pieces of data collected every day
- This is
- 2.7 billion a week
- 140 billion pieces of data a year
- And this is growing
- If all of Europe was Universally metered
- 2.7 trillion pieces of data would be collected every year at a 1-hour collection interval
......turning it into information.......
......and using it – the application